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| EXAMINER |
|---|
| GREENE, JASON M |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1724 | |

DATE MAILED: 07/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. 10/700,904 | Applicant(s) MEEGAN, G. DOUGLAS | |
|---|---|---|---|
| | **Examiner** Jason M. Greene | **Art Unit** 1724 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *22 June 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-30,32-35 and 37-197* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *121-123* is/are allowed.

6)☒ Claim(s) *1-15,17-30,32-35,37-78,80-120,124-180 and 184-197* is/are rejected.

7)☒ Claim(s) *16,79 and 181-183* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/22/06*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 22 June 2006 has been entered.

### *Response to Amendment*

### *Response to Arguments*

2. Applicant's arguments, see page 3, line 20 to page 6, line 13, filed 22 June 2006, with respect to the rejection(s) of claim(s) 1-5, 7-11, 17-19, 24, 25, 29, 30, 32-35, 49-54, 56-58, 63-68, 72, 77, 78, 87, 102-105, 107, 124-133, 138-149, 177-180, 184-190, 192, 194, 195 and 195 under 35 USC 102 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made under 35 USC 103 in view of the Vicard et al. reference. While the Examiner agrees with Applicants that Goforth et al. does not teach

the acoustic field being modulated according to different frequency and amplitude modulation ranges, Vicard et al. does disclose such a limitation. Specifically, Vicard et al. teaches a plurality of acoustic generators, wherein the output of each generator has a varying frequency and amplitude. See col. 4, line 17 to col. 6, line 67. Since the acoustic generators each provide a modulated frequency and amplitude output, the reference is seen as teaching the newly added limitation.

3. Applicant's arguments filed 22 June 2006 regarding the obviousness rejections have been fully considered but they are not persuasive. Specifically, as noted above, the arguments are not persuasive since the Vicard et al. reference teaches the acoustic field being modulated according to different frequency and amplitude modulation ranges.

## *Claim Rejections - 35 USC § 103*

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1-11, 17-19, 24, 25, 29, 30, 32-35, 37-48, 150-180, 184-190, 192 and 195-197 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goforth et al. in view of Vicard et al.

With regard to claims 1, 177, 178, 190 and 195, Goforth et al. discloses an apparatus for removing constituent from a fluid stream comprising a duct (68,70,74) having a fluid passageway to receive a fluid stream having constituent, a manifold system (horn 16 and isolator 32) coupled to the duct such that the manifold system communicates with the fluid passageway, a collection device (lower portion of 70) coupled to the duct, the collection device in communication with the fluid passageway to filter the fluid stream, a sorbent injector (86) to inject a sorbent in the fluid passageway of the duct, wherein the injection of the sorbent is upstream of the collection device, and an acoustic generator (72 and siren 14) coupled to the manifold system and operable to generate an acoustic field in the fluid passageway of the duct to promote sorption of at least of the constituent for collection by the collection device, wherein the acoustic field has a frequency of sound determined to increase acoustical stimulation determined by trial-and-error by observing the transfer of the constituent towards the sorbent over several frequencies and selecting the frequency that provides the greatest transfer of the sorbent (see col. 7, lines 22-64) in Figs. 1-7 and col. 3, line 28 to col. 17, line 7.

Goforth et al. does not teach the acoustic field being modulated according to different frequency and amplitude modulation ranges.

Vicard et al. discloses a similar apparatus comprising a plurality of acoustic generators, wherein the output of each generator has a varying frequency and amplitude such that the acoustic field is modulated according to different frequency and amplitude modulation ranges in col. 4, line 17 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the frequency and amplitude modulation of Vicard et al. into the apparatus of Goforth et al. to allow the operation of the apparatus to be continually optimized, as suggested by Vicard et al. in col. 4, lines 17-27

With regard to claim 2, Goforth et al. discloses the acoustic generator being an array of sound sources mounted along the duct to produce a plurality of acoustic fields in the fluid passageway in col. 6, lines 13-67.

With regard to claims 3, 4, 179 and 184-189, Goforth et al. discloses the acoustic field having a peak sound pressure level references to 20 microPascals of 168 dB and a frequency of 500 Hz in col. 7, lines 23-42.

With regard to claims 5 and 7, Goforth et al. discloses the acoustic field having a periodic sinusoidal waveform in col. 5, line 55 to col. 6, line 12.

With regard to claims 6, 42-46, 55, 137 and 150-176, Goforth et al. discloses each of the acoustic generators being adapted to generate an acoustic field that is frequency and amplitude modulable unique relative to each of the other plurality of acoustic generators but does not disclose the acoustic field being having a modulated waveform or each of the plurality of acoustic generators being adapted to generate a modulated acoustic field in the duct.

Vicard et al. teaches a similar apparatus using a frequency and amplitude modulated acoustic field in Figs. 1-5 and col. 4, line 17 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the frequency and amplitude modulation of Vicard et al. into the apparatus of Goforth et al. to allow the operation of the apparatus to be continually optimized, as suggested by Vicard et al. in col. 4, lines 17-27.

With regard to claims 8, 17, 30 and 35, Goforth et al. discloses the fluid stream being a combustion exhaust gas from a coal fired power plant and at least a portion of the constituent being vapor and fly ash in col. 3, lines 11-37.

With regard to claims 9-11, 18 and 19, Goforth et al. discloses the sorbent being powdered or granular in col. 10, lines 1-26 and col. 12, lines 11-28. At least a portion of the constituent comprises oxidized and elemental mercury since the exhaust stream is an exhaust gas from a coal fired power plant.

With regard to claim 24, Goforth et al. discloses the apparatus comprising a hopper (bottom portion of 70) operatively positioned to accumulate at least a portion of the constituent removed from the fluid stream in Fig. 7.

With regard to claim 25, Goforth et al. discloses the collection device being a filter in col. 10, lines 1-12.

With regard to claim 29, Goforth et al. discloses the collection device being a gravitational settling chamber (70) in Figs. 1-7 and col. 3, line 28 to col. 17, line 7.

With regard to claims 32-34, Goforth et al. teaches the acoustic field being frequency and amplitude modulable since the reference teaches optimizing the frequency and amplitude in col. 7, lines 22-64.

With regard to claims 37-41, Goforth et al. does not explicitly disclose the power plant being fired by the recited fuels. However, the fuels recited in claims 37-41 are well known in the art for firing power plants.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the prior art fuels into the apparatus of Goforth et al. to allow the power plant to operate on the most economical or convenient fuel.

With regard to claims 47, 48 and 196, Goforth et al. does not disclose the apparatus comprising an emission analyzer operable to receive information concerning the fluid stream.

Vicard et al. teaches a similar apparatus comprising an emission analyzer (control system 40) operable to receive information concerning the fluid stream, wherein a frequency of the sound field is selected based upon information received from the

emissions analyzer concerning the fluid stream in Figs. 1-5 and col. 5, line 29 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the emission analyzer of Vicard et al. into the apparatus of Goforth et al. to allow the frequency and amplitude to be optimized in response to the operation of the apparatus, as suggested by Vicard et al. in col. 4, lines 17-27 and col. 5, lines 50-64.

With regard to claim 80, Goforth et al. does not disclose the determining the frequency by applying a model based upon parameters of the fluid stream.

Vicard et al. teaches a similar method wherein the frequency of an acoustic field is determined by applying a model based upon parameters of the fluid stream (control system 40) in Figs. 1-5 and col. 5, line 29 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the model of Vicard et al. into the method of Goforth et al. to eliminate the trail and error approach of Goforth, as suggested by Vicard et al. in col. 4, lines 17-27 and col. 5, lines 50-64.

With regard to claim 180, Goforth et al. discloses the manifold system including a main chamber (lower portion of 16) in communication with the fluid passageway of the duct and at least a first channel (upper portion of 16) in communication with the main chamber in communication with the main chamber in Fig. 1.

With regard to claim 192, Goforth et al. discloses the substance having a reacting surface and the collection device are part of a catalytic converter (88) in Fig. 7 and col. 15, lines 34-41.

With regard to claim 197, Goforth et al. teaches determining a frequency of the acoustic field to apply to the fluid stream by trial-and-error by observing the transfer of the constituent towards the sorbent over several frequencies and selecting the frequency that provides the greatest transfer of the sorbent in col. 7, lines 22-64.

6. Claims 49-58, 63-68, 72, 77, 78, 80, 81, 102-105, 107 and 124-149 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goforth et al. in view of Vicard et al.

With regard to claims 49, 50, 102-105, 124-133, 138, 139, 143-145 and 147-149 Goforth et al. discloses a method for removing constituent from a fluid stream by enhancing mass transfer from a dilute vapor towards the surface of a sorbent comprising providing a fluid stream having a dilute vapor, injecting a sorbent (injector 86) in the fluid stream, the fluid stream having constituent, and applying a modulable (adjustable) acoustic field (generators 72) in the fluid stream to promote sorption of at least some of the constituent, providing a collection device (lower portion of 70) in communication with the fluid stream, the collection device being downstream relative to a point where the sorbent is injected into the fluid stream, wherein the acoustic field has a frequency of sound determined to increase acoustical stimulation determined by trial-

and-error by observing the transfer of the constituent towards the sorbent over several frequencies and selecting the frequency that provides the greatest transfer of the sorbent (see col. 7, lines 22-64) in Figs. 1-7 and col. 3, line 28 to col. 17, line 7.

Goforth et al. does not teach the acoustic field being modulated according to different frequency and amplitude modulation ranges.

Vicard et al. discloses a similar method comprising a plurality of acoustic generators, wherein the output of each generator has a varying frequency and amplitude such that the acoustic field is modulated according to different frequency and amplitude modulation ranges in col. 4, line 17 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the frequency and amplitude modulation of Vicard et al. into the method of Goforth et al. to allow the operation of the apparatus to be continually optimized, as suggested by Vicard et al. in col. 4, lines 17-27

With regard to claims 51, 107 and 137 Goforth et al. discloses the step of applying an acoustic field including providing an array of sound sources mounted along the duct to produce a plurality of acoustic fields in the fluid passageway of the duct in col. 6, lines 13-67.

With regard to claims 52, 53 and 140-142, Goforth et al. discloses the acoustic field having a peak sound pressure level references to 20 microPascals of 168 dB and a frequency of 500 Hz in col. 7, lines 23-42.

With regard to claims 54 and 56, Goforth et al. discloses the acoustic field having a periodic sinusoidal waveform in col. 5, line 55 to col. 6, line 12.

With regard to claims 57, 58, 63-65, 77 and 146, Goforth et al. discloses the fluid stream being a combustion exhaust gas from a coal fired power plant, at least a portion of the constituent being vapor, fly ash and mercury, and the sorbent being powdered or granular in col. 3, lines 11-37, col. 10, lines 1-26 and col. 12, lines 11-28. At least a portion of the constituent comprises mercury since the exhaust stream is an exhaust gas from a coal fired power plant.

With regard to claim 66, Goforth et al. discloses providing a hopper (bottom portion of 70) operatively positioned to accumulate at least a portion of the constituent removed from the fluid stream in Fig. 7.

With regard to claims 67 and 68, Goforth et al. discloses filtering the fluid stream with a collection device comprising a filter in col. 10, lines 1-12.

With regard to claim 72, Goforth et al. discloses the collection device being a gravitational settling chamber (70) in Figs. 1-7 and col. 3, line 28 to col. 17, line 7.

With regard to claims 78 and 81, Goforth et al. teaches determining a frequency of the acoustic field to apply to the fluid stream by trial-and-error by observing the transfer of the constituent towards the sorbent over several frequencies and selecting the frequency that provides the greatest transfer of the sorbent in col. 7, lines 22-64.

With regard to claims 134-136, Goforth et al. does not disclose the specific cross-sectional shape of the duct.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the duct as having one of the recited cross-sectional shapes to provide a duct having an optimum shape for installation in a specific area.

7. Claims 1-8, 13-15, 17, 19-23, 25, 26, 30, 32-35, 37-48, 82-88, 90-97, 101, 190, 194 and 195 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eng et al. in view of Vicard et al.

With regard to claims 1, 25, 47, 48, 82, 90, 190, 194 and 195 Eng et al. discloses an apparatus for removing constituent from a fluid stream comprising a spray scrubber tower defining a duct (10) having a chamber defining a fluid passageway (16) to receive a fluid stream having constituent, a collection device comprising a filter (300) coupled to the duct, the collection device in communication with the fluid passageway to filter the fluid stream, a liquid sorbent injector (water sprayer 104) coupled to the scrubber tower to inject a liquid sorbent in the fluid passageway of the duct of the scrubber tower,

wherein the injection of the sorbent is upstream of the collection device, and an acoustic generator (102) to generate an acoustic field in the fluid passageway of the duct to promote sorption of at least of the constituent for collection by the collection device and to promote a chemical reaction between the liquid and at least some of the constituent in Fig. 1 and col. 4, line 69 to col. 10, line 31.

Eng et al. does not disclose the acoustic field having a frequency of sound determined to increase the acoustic stimulation or the apparatus comprising an emission analyzer operable to receive information concerning the fluid stream or the acoustic field being modulated according to different frequency and amplitude modulation ranges.

Vicard et al. teaches a similar apparatus comprising an emission analyzer (control system 40) operable to receive information concerning the fluid stream, wherein a frequency of the sound field is selected based upon information received from the emissions analyzer concerning the fluid stream, wherein the output of each acoustic generator has a varying frequency and amplitude such that the acoustic field is modulated according to different frequency and amplitude modulation ranges in Figs. 1-5 and col. 4, line 17 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the emission analyzer and frequency and amplitude modulation of Vicard et al. into the apparatus of Eng et al. to allow the frequency and amplitude to be continuously optimized in response to the operation of the apparatus, as suggested by Vicard et al. in col. 4, lines 17-27 and col. 5, lines 50-64.

With regard to claims 2, 4, 31-35, 42-44 and 97, Eng et al. discloses the acoustic generator being defined as an array of sound sources mounted along the duct to produce a plurality of acoustic fields in the fluid passageway of the duct, wherein each of the plurality of acoustic generators is adapted to generate a frequency modulated acoustic field unique relative to each of the other plurality of acoustic generators, wherein the acoustic field is amplitude modulable and has a frequency of 10 kHz in Fig. 1 and col. 9, lines 48-57.

With regard to claim 3, Eng et al. discloses the acoustic field having a frequency modulated sinusoidal periodic waveform, a frequency of 10kHz, and a peak sound pressure referenced to 20 microPascals of greater than 110 dB in col. 9, lines 54-57. Since the prior art range of peak sound pressure is seen as overlapping the claimed range, a prima facie case of obviousness exists which must be overcome through a showing of unexpected or unobvious results.

With regard to claims 5-8, 17, 30 and 83-85, Eng et al. discloses the acoustic field being defined as a frequency modulated sinusoidal periodic waveform, the fluid stream being a gas exhaust stream, and at least a portion of the constituent being vapor (sulfur oxides and nitrogen oxides from the combustion process) and fly ash in col. 1, lines 24-29 and col. 7, lines 4-53.

With regard to claim 15, Eng et al. discloses the apparatus further comprising a second collection device (reservoir 28) upstream of the sorbent injector in Fig. 1 and col. 5, lines 7-21.

With regard to claim 20, Eng et al. discloses the apparatus comprising a second acoustic generator (34) adapted to generate a frequency modulated acoustic field in the fluid passageway of the duct upstream of the sorbent injector to promote agglomeration of at least a portion of the constituent in the fluid stream in Fig. 1 and col. 5, lines 27-72.

With regard to claims 21, 22 and 26, Eng et al. discloses the collection device being an electrostatic precipitator (306), wherein the apparatus further comprises a second collection device (the second grid 308) coupled downstream of a point of application of the frequency modulated acoustic field, the collection device and second collection device being in communication with the fluid passageway to promote removal of the agglomerated constituent in Fig. 1 and col. 9, line 68 to col. 10, line 31.

With regard to claims 13, 14 and 91-96 Eng et al. discloses at least a portion of the constituent being an oxide of sulfur and an oxide of nitrogen, wherein the sorbent is water in col. 1, lines 24-29 and col. 5, lines 1-21.

Eng et al. does not disclose the sorbent being a limestone slurry.

Vicard et al. discloses a similar apparatus using a limestone slurry (lime milk) as a sorbent in Figs. 1-5 and col. 5, lines 29-58.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the limestone of Vicard et al. into the water sorbent of Eng et al. to enhance the adsorption efficiency of sulfur oxides, as is well known in the art.

With regard to claims 23, 45, 46, 76, 137 and 150-153 Eng et al. discloses each of the acoustic generators being adapted to generate an acoustic field that is frequency and amplitude modulable unique relative to each of the other plurality of acoustic generators but does not disclose the acoustic being having an amplitude modulated waveform or each of the plurality of acoustic generators being adapted to generate an amplitude modulated acoustic field in the duct.

Vicard et al. teaches a similar apparatus using a frequency and amplitude modulated acoustic field in Figs. 1-5 and col. 4, line 17 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the amplitude modulation of Vicard et al. into the apparatus and method of Eng et al. to allow the operation of the apparatus to be continually optimized, as suggested by Vicard et al. in col. 4, lines 17-27.

With regard to claims 47 and 48, Eng et al. does not disclose the apparatus comprising an emission analyzer operable to receive information concerning the fluid stream.

Vicard et al. teaches a similar apparatus comprising an emission analyzer (control system 40) operable to receive information concerning the fluid stream, wherein a frequency of the sound field is selected based upon information received from the emissions analyzer concerning the fluid stream in Figs. 1-5 and col. 5, line 29 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the emission analyzer of Vicard et al. into the apparatus of Eng et al. to allow the frequency and amplitude to be optimized in response to the operation of the apparatus, as suggested by Vicard et al. in col. 4, lines 17-27 and col. 5, lines 50-64.

With regard to claims 19, 37-41, 86-88, 101 and 110-115, Eng et al. does not explicitly disclose the power plant being fired by the recited fuels. However, the fuels recited in claims 19 and 37-41 are well known in the art for firing power plants. Additionally, the constituent will include elemental and oxidized mercury when coal is used to fire the power plant.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the prior art fuels into the apparatus of Eng et al. to allow the power plant to operate on the most economical or convenient fuel.

8. Claims 49-57, 60-63, 67-69, 73-77, 98-100, 102-105, 107-117, 119, 124-176 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eng et al. in view of Vicard et al.

With regard to claims 49, 50, 60, 61, 67, 68, 102-105, 108, 109, 119, 124-133, 138, 139, 143-145, 147-149 and 154-159, Eng et al. discloses a method for removing constituent from a fluid stream by enhancing mass transfer from a dilute vapor towards the surface of a sorbent comprising providing a fluid stream having a dilute vapor injecting a sorbent (injector 104) in the fluid stream, the fluid stream having constituent, and applying a frequency modulated (see col. 9, lines 48-57) acoustic field (generators 102) in the fluid stream to promote sorption of at least some of the constituent, providing a collection device comprising a filter (300) in communication with the fluid stream, the collection device being downstream relative to a point where the sorbent is injected into the fluid stream in Fig. 1 and col. 4, line 69 to col. 10, line 31.

Eng et al. does not disclose the acoustic field having a frequency of sound determined to increase the acoustic stimulation or the acoustic field being modulated according to different frequency and amplitude modulation ranges.

Vicard et al. teaches a similar method comprising an emission analyzer (control system 40) operable to receive information concerning the fluid stream, wherein a frequency of the sound field is selected based upon information received from the emissions analyzer concerning the fluid stream, and wherein the output of each acoustic generator has a varying frequency and amplitude such that the acoustic field is

modulated according to different frequency and amplitude modulation ranges in Figs. 1-5 and col. 4, line 17 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the emission analyzer of Vicard et al. into the method of Eng et al. to allow the frequency and amplitude to be continually optimized in response to the operation of the apparatus, as suggested by Vicard et al. in col. 4, lines 17-27 and col. 5, lines 50-64.

With regard to claims 51, 53-56, 107, 117, 140-142 and 160-174 Eng et al. discloses the step of applying an acoustic field including providing an array of sound sources mounted along the duct to produce a plurality of acoustic fields in the fluid passageway of the duct, wherein the acoustic field has a frequency modulated periodic sinusoidal waveform, a frequency of 10 kHz, and a peak sound pressure referenced to 20 microPascals of greater than 110 dB in col. 9, lines 48-57.

With regard to claims 57, 63, 77, 146, 175 and 176, Eng et al. discloses the fluid stream being a combustion exhaust gas from a power plant, at least a portion of the constituent being vapor (sulfur gases) and fly ash in col. 1, lines 24-29 and col. 7, lines 4-53.

With regard to claims 60, 61 and 116, Eng et al. discloses at least a portion of the constituent being an oxide of sulfur and an oxide of nitrogen, wherein the sorbent is water in col. 1, lines 24-29 and col. 5, lines 1-21.

Eng et al. does not disclose the sorbent being a limestone slurry.

Vicard et al. discloses a similar apparatus using a limestone slurry (lime milk) as a sorbent in Figs. 1-5 and col. 5, lines 29-58.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the limestone of Vicard et al. into the water sorbent of Eng et al. to enhance the adsorption efficiency of sulfur oxides, as is well known in the art.

With regard to claim 62, Eng et al. discloses providing a second collection device (reservoir 28) upstream of the sorbent injector in Fig. 1 and col. 5, lines 7-21.

With regard to claim 73, Eng et al. discloses providing a second acoustic generator (34) adapted to generate a frequency modulated acoustic field in the fluid passageway of the duct upstream of the sorbent injector to promote agglomeration of at least a portion of the constituent in the fluid stream in Fig. 1 and col. 5, lines 27-72.

With regard to claims 69, 74 and 75, Eng et al. discloses the collection device being an electrostatic precipitator (306), wherein the method further comprises providing second collection device (the second grid 308) coupled downstream of a point of

application of the frequency modulated acoustic field, the collection device and second collection device being in communication with the fluid passageway to promote removal of the agglomerated constituent in Fig. 1 and col. 9, line 68 to col. 10, line 31.

With regard to claims 76, 137 and 150-153 Eng et al. discloses each of the acoustic generators being adapted to generate an acoustic field that is frequency and amplitude modulable unique relative to each of the other plurality of acoustic generators but does not disclose the acoustic being having an amplitude modulated waveform or each of the plurality of acoustic generators being adapted to generate an amplitude modulated acoustic field in the duct.

Vicard et al. teaches a similar apparatus using a frequency and amplitude modulated acoustic field in Figs. 1-5 and col. 4, line 17 to col. 6, line 67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the amplitude modulation of Vicard et al. into the apparatus and method of Eng et al. to allow the operation of the apparatus to be continually optimized, as suggested by Vicard et al. in col. 4, lines 17-27.

With regard to claims 110-115, Eng et al. does not explicitly disclose the power plant being fired by the recited fuels. However, the fuels recited in claims 110-115 are well known in the art for firing power plants. Additionally, the constituent will include elemental and oxidized mercury when coal is used to fire the power plant.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the prior art fuels into the method of Eng et al. to allow the power plant to operate on the most economical or convenient fuel.

With regard to claims 52 and 98-100, Eng et al. discloses the acoustic field having a frequency modulated sinusoidal periodic waveform, a frequency of 10kHz, and a peak sound pressure referenced to 20 microPascals of greater than 110 dB in col. 9, lines 54-57. Since the prior art range of peak sound pressure is seen as overlapping the claimed range, a prima facie case of obviousness exists which must be overcome through a showing of unexpected or unobvious results.

With regard to claims 134-136, Eng et al. does not disclose the specific cross-sectional shape of the duct.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the duct as having one of the recited cross-sectional shapes to provide a duct having an optimum shape for installation in a specific area.

9. Claims 12, 59 and 106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goforth et al. and Vicard and further in view of Wojtowicz et al.

Goforth et al. does not disclose the sorbent being activated carbon.

Wojtowicz et al. teaches a similar apparatus and method wherein activated carbon is used to remove mercury in col. 1, lines 24-46.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the activated carbon of Wojtowicz et al. into the apparatus of Goforth et al. to provide an adsorbent that can be reactivated to minimize the amount of spent adsorbent that must be disposed of, as suggested by Wojtowicz et al. in col. 1, lines 42-46.

10. Claims 27, 28, 70 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goforth et al. and Vicard et al., and further in view of Chang et al.

Goforth et al. discloses the collection device comprising a filter in col. 10, lines 1-12 but does not disclose using a baghouse or a cyclone separator.

Chang et al. teaches a similar apparatus and method wherein sorbent particles are removed using a particulate collection device including a baghouse in Figs. 1 and 2 and col. 5, lines 50-55. While Chang et al. does not explicitly recite using a cyclone separator, one of ordinary skill in the art would at once envisage the particulate collection device encompassing cyclone separators since they are well known in the art for removing particulates from gas streams.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the particulate collection device of Chang et al. into the apparatus and method of Goforth et al. to ensure that all sorbent particulates are removed from the fluid stream, as suggested by Chang et al. in col. 5, lines 50-55. Furthermore, while Goforth et al. teaches baghouses not being required in col. 10, lines 20-27, the reference does not teach away from incorporating a baghouse into the

apparatus or method. Goforth et al. merely teaches that a conventional baghouse filter is not required to stagnate the sorbent particles due to the use of the acoustic field. One of ordinary skill in the art would have recognized that a baghouse could have still been incorporated downstream of the acoustic field to remove any particulate sorbent entrained in the fluid stream.

11. Claims 89, 118, 120, 191 and 193 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eng et al. and Vicard et al., and further in view of Chang et al.

Eng et al. does not disclose the scrubber tower being a packed scrubber tower or including a fixed bed adsorber.

Chang et al. teaches using a packed bed of activated carbon to remove vapor phase constituents in col. 1, lines 44-48.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the packed bed of Chang et al. into the scrubber tower of Eng et al. to enhance the adsorption of mercury and other vaporous constituents in the fluid stream, as suggested by Chang et al. in col. 1, lines 44-48.

### ***Allowable Subject Matter***

12. Claims 121-123 are allowed.

13. As previously indicated, claims 16, 79 and 181-183 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

## ***Conclusion***

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Greene whose telephone number is (571) 272-1157. The examiner can normally be reached on Monday - Friday (9:00 AM to 5:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571) 272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Jason M. Greene
Primary Examiner
Art Unit 1724

Jason M. Greene
7/20/06

jmg
July 20, 2006